

## When is Colour Required by Machine Vision?

**Although the past few years have seen the machine vision (MV) industry undergo some revolutionary changes, one area that continues to advance at a relatively slow pace is that of colour imaging.**

One of the historical reasons for the slow adoption of colour in MV has been that solving a MV problem with colour has always required more money and processing power than an equivalent monochrome solution. The situation has changed in recent years. The cost of MV hardware and software has dropped drastically bringing both monochrome and colour solutions within reach of companies that until recently, would have laughed the MV sales rep. right out the door.

As any MV professional will tell you, the application always dictates the solution. In other words, it is in the details of your application that you will find the answer to the question: "should I be using colour for this?" Let's say you are trying to detect scratches or foreign matter defects (bumps) in the colour finish of your spindle-banger-6000. One might assume that since the defects are on a colour surface that colour would be the way to go, right? Well, let's take a closer look before we jump to any conclusions. In this instance, the defects (scratches & bumps) disrupt the evenness of a surface, which in turn affects the way light is reflected. What is going on is this, when you are grabbing images of a homogeneous surface (i.e. a surface that is perfect and does not have any discernable texture), all the pixels in your image will be about the same. But, as soon as you grab an image of a scratch or a bump, suddenly light gets scattered in different directions. In other words, scratches and bumps create areas of pixels that are darker and lighter, which means you don't need colour.

The sharpest among you have no doubt noticed I still haven't answered the question of when to use colour in MV. So here's the short answer: use colour any time you need to evaluate the presence or density of a colour, it's evenness of distribution, or it's similarity to some known reference (note: you may also be faced with any combination of the aforementioned requirements). Let's look at a few real world situations that will hopefully leave you with some handy insight for the next time you are faced with the decision of whether or not colour should be part of your application.

Food is probably the application area that everyone inherently understands the best, because as daily consumers of food, we are constantly judging the quality and consistency of the food we buy. For fruit, colour allows us to ascertain ripeness and grade product quality (nobody wants to buy a blotchy orange, or a half yellow lime). In the case of grains and legumes, colour helps to grade product quality and distinguish foreign matter in a steady stream of product. In meat processing, colour can be used to detect spoilage and discriminate areas of fat, bone and gristle for automatic trimming. Why, colour machine vision is even used to inspect the 'build' quality of frozen pizza! Think about it, with a monochrome image, you might

be able to tell if the density of ingredients is correct (i.e. enough of them and if they are properly spread out). But you will have a great deal of trouble telling the difference between some of the chopped ingredients. Take for example, orange, red and green peppers. In colour, they are easy to tell apart, in monochrome, not so much...



Colour is used to ascertain ripeness and grade product quality of fruits and vegetables

Another area where colour MV is used is in automotive inspection. "Ah yes, car paint!", actually no. Car manufacturers have been using automated paint systems for years without the need for automated visual inspection – for a long time, they had no choice. But, where the bulk of the effort goes today is inspecting the fine visual details that make up the person-machine-interface (pardon my political correctness). For example, making sure the consistency and evenness of the instrument-cluster light panel. This is important because the look and overall quality of the instrument-cluster and dashboard go a long way towards contributing to driver's impression of a car's quality.

Obviously, there are many other applications that require colour, like print inspection (quality/registration), pharmaceutical inspection (label verification), part presence and/or detection, PCB assembly (part presence, verification and placement). In addition, there's a slew of quality and grading applications that involve colour and texture classification for things like wood, textiles and ceramic tile to name just a few. By now, it should be clear that using colour in some types of MV applications is a no-brainer. But, when you are faced with an application that instils some doubt, ask yourself the following questions:

- Is the object's colour quality and consistency a key factor in the overall quality of your product?
- Can the object's colour help you to ascertain the relative quality of your product?
- Will colour facilitate detection of the object?

If the answer to any of these questions is yes, then you should take a serious look at the colour side of machine vision.

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